National Aeronautics
and Space Administration

Educational Product	
Teachers	Grades K-12

EG-2000-10-64-MSFC

OPTICS

Light, Color, and Their Uses

An Educator's Guide With Activities In Science and Mathematics

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Optics:
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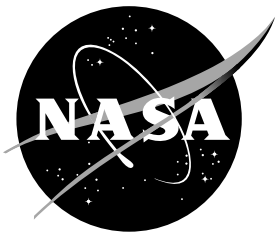

National Aeronautics and Space Administration

Space Optics Manufacturing Technology Center
Marshall Space Flight Center

Customer Employee Relations Directorate /
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On the Cover

Replicated X-ray Mirror

The reflective tube is an x-ray telescope mirror made as a shell cast from a mold called a mandrel. The cylindrical mandrel is carefully shaped and polished until it has the proper optical surface. Then gold, followed by nickel, is electroplated onto the mandrel. The electroplated metal then comes off the mandrel and the shell formed is a high-precision mirror on the inside. The mandrel can be used again to replicate many mirrors with the same shape.

The x-ray mirrors in the Chandra Observatory are made of glass. Metal mirrors replicated from a mandrel are much lighter and cheaper than glass, so they are desirable for space applications. The Marshall Space Flight Center (MSFC) is advancing replicated optics technology.

Shown in the picture are students Colton Guthrie and Laquita Hurt, with MSFC optical physicist Vince Huegele.

Classroom Activities

This material has been developed to provide a guide to hands-on experiences in science and mathematics. The activity plans are written to be used by the students in groups of two to four people in a lab-type setting.

Each lab session should begin with a brief discussion of the theory section of each lesson plan. The teacher should feel free to adjust the information and activities to meet the needs of the students. For the very young student, the teacher may want to lead the experience activity and adapt the questions.

Pat Armstrong

Activities for Grades K–4

Activity 1: Reflection of Light With a Plane (Flat) Mirror
Activity 2: Reflection of Light With Two Plane Mirrors
Activity 7: Exploring Diffraction With a Spectroscope
Activity 10: Light and Color-Color Spinners
Activity 11: Light and Color-Filters
Activity 12: Light and Color-Hidden Messages
Activity 13: Simple Magnifiers

Activities for Grades 5–8

Activity 1: Reflection of Light With a Plane (Flat) Mirror
Activity 2: Reflection of Light Withe Two Plane Mirrors
Activity 3: Reflection of Light With Two Plane Mirrors-Double Sided
Activity 5: Making a Periscope
Activity 6: Constructing a Spectroscope
Activity 7: Exploring Diffraction with a Spectroscope
Activity 10: Light and Color-Color Spinners
Activity 12: Light and Color-Hidden Messages
Activity 13: Simple Magnifiers

Activities for Grades 9–12

Activity 4: Making a Kaleidoscope
Activity 5: Making a Periscope
Activity 8: Diffraction of Light by Very Small Apertures
Activity 9: Discovering Color With a Prism
Activity 14: Focusing Light With a Lens
Activity 15: Building a Telescope
Activity 16: Building a Microscope
Activity 17: Interference Fringes
Activity 18: Polarization of Light

Table of Contents

Light, Color, and Their Uses

Activity / Lesson

National Science Standards

	Activity/Lesson	Science as Inquiry	Physical Science
1.	Reflection/Plane Mirror	☑	☑
2.	Reflection/2 Mirrors	☑	☑
3.	Reflection/Double Mirrors	☑	☑
4.	Making a Kaleidoscope	☑	☑
5.	Construction of a Kaleidoscope	☐	☑
6.	Making a Periscope	☑	☑
7.	Constructing a Spectroscope	☐	☑
8.	Exploring Diffraction	☑	☑
9.	Electromagnetic Spectrum	☑	☑
10	Diffraction of Light	☑	☑
11.	Discovering Color/Prism	☑	☑
12.	Fabrication of a Prism	☑	☑
13.	Color Spinners	☑	☑
14.	Filters	☑	☑
15.	Hidden Messages	☑	☑
16.	Simple Magnifiers	☑	☑
17.	Focusing Light With a Lens	☑	☑
18.	Building a Telescope	☑	☑
19.	Building a Microscope	☑	☑
20.	Construction of a Micoscope	☐	☑
21.	Interference Fringes	☑	☑
22.	Polarization of Light	☑	☑

National Mathematics Standards

Activity/Lesson	Problem Solving	Communication	Connection	Computation/Estimation	Measurement
1. Reflection/Plane Mirror	☐	☑	☐	☐	☑
2. Reflection/2 Mirrors	☐	☑	☐	☐	☑
3. Reflection/Double Mirrors	☑	☑	☐	☑	☑
4. Making a Kaleidoscope	☐	☑	☑	☐	☐
5. Construction of a Kaleidoscope	☐	☑	☑	☑	☑
6. Making a Periscope	☐	☑	☑	☑	☐
7. Constructing a Spectroscope	☐	☑	☑	☐	☑
8. Exploring Diffraction	☐	☑	☐	☐	☐
9. Electromagnetic Spectrum	☐	☑	☐	☐	☐
10 Diffraction of Light	☐	☑	☐	☐	☐
11. Discovering Color/Prism	☐	☑	☐	☐	☐
12. Fabrication of a Prism	☐	☑	☐	☐	☑
13. Color Spinners	☑	☑	☐	☑	☑
14. Filters	☐	☑	☐	☑	☐
15. Hidden Messages	☐	☑	☐	☑	☐
16. Simple Magnifiers	☐	☑	☐	☐	☐
17. Focusing Light With a Lens	☑	☑	☐	☐	☐
18. Building a Telescope	☐	☑	☑	☐	☐
19. Building a Microscope	☐	☑	☑	☐	☐
20. Construction of a Micoscope	☐	☑	☑	☑	☑
21. Interference Fringes	☐	☑	☐	☐	☐
22. Polarization of Light	☐	☑	☐	☐	☐